COMMITTEE ON PROSTHETICS RESEARCH AND DEVELOPMENT DIVISION OF MEDICAL SCIENCES— NATIONAL RESEARCH COUNCIL NATIONAL ACADEMY OF SCIENCES—NATIONAL ACADEMY OF ENGINEERING

ANNUAL SUMMARY REPORT ACTIVITIES FOR YEAR ENDED JUNE 30, 1972[a]

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[a] This report was prepared as part of the work under Contract V101(134)P-75 between the Veterans Administration and the National Academy of Sciences; and under Contracts SRS-72-6 and SRS-72-7 between the Social and Rehabilitation Service, Department of Health, Education, and Welfare and the National Academy of Sciences.

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PURPOSE

The Committee on Prosthetics Research and Development engages in activities which serve research and general advancement in the fields of prosthetics, orthotics, and sensory aids.

The Veterans Administration, Department of Defense, and several divisions within the Department of Health, Education, and Welfare, notably the Social and Rehabilitation Service and the Maternal and Child Health Service, have responsibilities in the care of amputees and other individuals with orthopaedic and sensory disabilities and deprivations. A number of private foundations also have interests in these fields.

Because the overall volume of business in artificial limbs, orthopaedic appliances, and devices to assist the blind and deaf is small, private enterprises have not been stimulated to support extensive research. In order to maintain progress commensurate with other technical, medical, and paramedical fields, therefore, there has been a continuing need for

government agencies and private foundations to support research and development within their organizations or by establishing research contracts with univerities and industrial organizations, or by combinations of these two methods.

Operating within this milieu, the Committee on Prosthetics Research and Development seeks to:

- keep abreast of all new developments in prosthetics, orthotics, and sensory aids;
- correlate and coordinate research sponsored by the Veterans Administration, the Social and Rehabilitation Service, the National Institutes of Health, the Army, the Navy, and others;
- advise sponsors through National Academy of Sciences—National Research Council channels by means of special and periodic reports and personal liaison of the scope and progress of the program;
- recommend areas of need for future research;
- ensure that new devices and techniques that contribute to improved treatment are made available promptly to organizations concerned with the education of medical and paramedical personnel in these fields; and
- disseminate research results nationally and internationally through publication of the journal *Artificial Limbs* and other technical reports.

ORGANIZATION

The Committee on Prosthetics Research and Development operates within the Division of Medical Sciences of the National Research Council.[b] The Committee's membership is comprised of physicians, engineers, and representatives of other disciplines who are actively interested in furthering the development of prosthetic and orthotic devices and sensory aids and in the expeditious utilization of these improvements. Appointments to the Committee, normally for a 3-year period, are made by the Chairman of the Division of Medical Sciences with the approval of the President of the National Academy of Sciences.

In seeking to achieve its objectives, the Committee on Prosthetics Research and Development has over the years established five permanent subcommittees: the Subcommittee on Fundamental Studies, the Subcommittee on Design and Development, the Subcommittee on Evaluation, the Subcommittee on Child Prosthetics Problems, and the Subcommittee on Sensory Aids (Fig. 1).

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[b] CPRD was transferred to the Division of Medical Sciences from the Division of Engineering on March 15, 1972, in accordance with plans for eventual reorganization of the National Research Council.

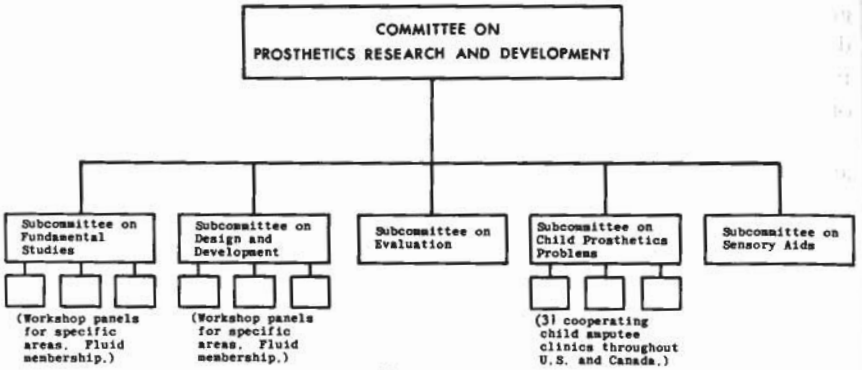

FIGURE 1

The Subcommittee on Fundamental Studies seeks to stimulate research which will provide basic information prerequisite in the design of improved prosthetic and orthotic devices. Basic research is also directed to obtaining data which will afford a better understanding of treatment processes. The subcommittee operates through small working panels which focus on specific subject areas and involve persons directly interested and/or engaged in research in those areas. Identification and coordination of currently available information is correlative with the stimulation of research in areas where information is needed.

In pursuing its goal of encouraging and coordinating the design and development of improved prosthetic and orthotic devices, the Subcommittee on Design and Development arranges periodic meetings of individuals actively working in specific areas. The subcommittee promotes an active interchange of information between developers, provides leadership in attacking critical problems, provides a forum for the evaluation of new ideas and suggestions, and encourages the endeavors of competent designers. Much of the activity of the Subcommittee on Design and Development is effected through so-called workshop panels. These panels now cover the entire spectrum of prosthetics and orthotics in discrete segments, *viz.*, lower-limb prosthetics, upper-limb prosthetics, lower-limb orthotics, upper-limb orthotics, and spinal orthotics.

The difficult, but essential, realm of evaluation of new and revised prosthetic and orthotic devices and techniques is a major continuing concern of the Committee on Prosthetics Research and Development. The Subcommittee on Evaluation encourages and coordinates an orderly effort to determine the relative merits of individual items stemming from the research and development program. The findings are passed along to the education groups and clinicians.

The Subcommittee on Child Prosthetics Problems provides a strong stimulus for research in prosthetics related to the juvenile amputee

population and disseminates the results of this research to clinicians and others engaged in the treatment of the child amputee. Under the auspices of this subcommittee, the Cooperative Child Amputee Research Program is carried on through 31 participating treatment centers which have met standards of practice established by the subcommittee. An important medium for the exchange of information within the clinic family is the *Inter-Clinic Information Bulletin* which is published monthly through New York University on behalf of the subcommittee. Material for the *Bulletin* is assembled and edited by the Assistant Executive Director of the Committee on Prosthetics Research and Development. In response to a charge from the parent committee, the Subcommittee on Child Prosthetics Problems is now in the process of enlarging its responsibilities to include orthotic needs of the juvenile patient. In this expansion of its activities, the subcommittee is focusing its attention initially on the orthotic requirements of children with cerebral palsy, spina bifida, and Legg-Perthes disease.

In fulfilling its role of providing advisory services to interested agencies, both governmental and private, the Subcommittee on Sensory Aids endeavors to keep fully informed of current activities in the development of sensory aids for the blind and partially sighted, and the deaf and hard of hearing, and to encourage and coordinate meritorious research in these areas.

The Committee on Prosthetics Research and Development is served by a staff of full-time personnel employed by the Academy-Research Council. It consists of an executive director, an assistant executive director, a staff engineer, a staff surgeon (one-half time), an editorial associate, an administrative assistant and three secretaries. (A staff engineer for sensory aids was added August 1, 1972.)

OPERATIONAL CONCEPT

General

The Committee on Prosthetics Research and Development endeavors to achieve its objectives in a variety of ways depending upon the requirements and circumstances of a given project. The Committee meets twice a year or as necessary to review the recommendations of its subcommittees and *ad hoc* committees. The subcommittees, whose members, like those of the parent committee, typically are appointed for a period of 3 years, also usually meet two or more times per year. Since the work of certain of the subcommittees is closely related, for example, Design and Development and Evaluation; and Design and Development and Child Prosthetics Problems, members of one subcommittee frequently attend meetings of other subcommittees.

A rewarding modus operandi in dealing with special topics or areas of interest, particularly under the Fundamental Studies and Design and Development subcommittees, has been the use of so-called workshop panels. Some degree of continuity is sought in the chairmanships of these panels. However, the participants in the workshops are selected for their special or technical knowledge in the area under review and hence may vary from meeting to meeting. *Ad hoc* committees for study of special problems are also freely used. Appointments to such *ad hoc* committees, as is true also of the workshop panels are not restricted to the membership of the Committee on Prosthetics Research and Development. Persons with the specialized knowledge to serve on the workshop panels and *ad hoc* committees are selected from a large number of qualified individuals affiliated with the Prosthetics Research Program and willing to serve. Personnel from the Educational Programs are included in order that the Educational Programs can be kept up to date on developments and thus effect a compression of the time required between research and education.

Governmental Relationships

Through the Academy-Research Council, the Committee on Prosthetics Research and Development provides advisory services to the Veterans Administration, and the Social and Rehabilitation Service of the Department of Health, Education, and Welfare. Liaison representatives designated by these governmental agencies participate without vote in the deliberations of the committee. Laboratories cooperating with the Committee on Prosthetics Research and Development include the Army Medical Biomechanical Research Laboratory, the Navy Prosthetics Research Laboratory, and the Veterans Administration Prosthetics Center. From time to time, individuals from these laboratories participate in the Committee's activities.

ACTIVITY REPORTS

General

During the period July 1, 1971, through June 30, 1972, the Committee on Prosthetics Research and Development provided continuing services in the coordination of government and privately sponsored research in the fields of prosthetics, orthotics, and sensory aids. At the request of the sponsoring agencies, the Committee reviewed 20 proposals for new research and development projects and 15 proposals for continuance of projects already in progress. *Ad hoc* groups appointed by the Committee conducted three site visits to development and treatment centers.

CPRD Meetings

The 23rd meeting of the Committee was held in Washington, D.C., November 15–16, 1971. Besides reports from the chairmen of the five subcommittees, various presentations were made of current research projects. Recommendations for continuing and future work were made with particular focus on the need for establishing clinical priorities. A comprehensive report of the meeting has been distributed.

Subcommittee on Fundamental Studies

The Subcommittee on Fundamental Studies seeks to stimulate research which will provide basic information prerequisite to the design of improved prosthetic and orthotic devices and to provide a better understanding of treatment processes.

A Steering Committee to plan a Workshop on Fundamental Studies for Internal Structural Prostheses met in Annapolis, Md., on August 2, 1971, and again on January 28, 1972, in Washington, D.C. The workshop was subsequently conducted at the University of Virginia at Charlottesville, Va., April 13–15, 1972, in collaboration with the American Academy of Orthopaedic Surgeons.

The subcommittee conducted a most successful Workshop on the Effect of Pressure on Soft Tissues at Baylor University, September 21–22, 1971. A comprehensive report of the workshop has been issued.

During the report period, the subcommittee's Panel on Locomotion and Gait Studies held a series of meetings to standardize data-collecting procedures.

Subcommittee on Design and Development

The Subcommittee on Design and Development sponsored several workshops during the report period:

An *ad hoc* Committee on Cosmesis for Endoskeletal Prostheses met in Annapolis, Md., July 19–20, 1971.

An *ad hoc* group met on July 21, 1971, to complete the report of the Conference on Cosmesis and Modular Limb Prostheses, which had been held in San Francisco, Calif., March 3–8, 1971.

A Workshop on Upper-Limb Orthotics was held in Hot Springs National Park, Ark., October 3–5, 1971.

A Workshop on Upper-Limb Prosthetics was held at Northwestern University, Chicago, Ill., October 25–27, 1971.

A Workshop on Spinal Orthotics sponsored jointly by CPRD and the American Academy of Orthopaedic Surgeons was held in Washington, D.C., October 28–29, 1971.

Subcommittee on Evaluation

The Subcommittee on Evaluation held its 13th meeting in Washington, D.C., August 5–6, 1971. Results of the clinical evaluation program involving four lower-limb orthoses were reviewed.

Throughout the year, a biomechanical analysis and comparative study of 12 below-knee orthoses have continued at Moss Rehabilitation Hospital in Philadelphia under the jurisdiction of the subcommittee.

Following planning meetings on October 20, and November 29, 1971, an orientation course on selected ankle-foot orthoses was held at New York University, January 10–14, 1972. This course was preliminary to a study of new technical analysis forms and revised nomenclature and prescription procedures, as well as three selected orthoses.

An orientation seminar on The Application of the Ljubljana Functional Electronic Peroneal Brace was held in Houston, Texas, April 19–21, 1971, followed by a clinical applications study of this device. On March 18, 1972, a meeting to review progress in the evaluation of the Ljubljana *F*unctional *E*lectrical *S*timulator was held at Rancho Los Amigos Hospital.

Over the period May 1–6, 1972, the Staff Engineer toured the centers participating in the study. He was accompanied by Dr. Franjo Gracanin from the Ljubljana project which developed the device. This study is continuing.

The Vice-Chairman and Executive Director attended a meeting at Rancho Los Amigos Hospital to develop plans for a study of the Medtronic-Rancho Implanted Peroneal Stimulator. This study will be activated during FY 1972–73.

Subcommittee on Child Prosthetics Problems

The Subcommittee on Child Prosthetics Problems maintained an active research program in prosthetics for children throughout the year and took steps to initiate a research program in children's orthotics. Thirty-one clinics specializing in the treatment of the child with limb deficiencies are now participating in the cooperative research program. Three clinics have been recruited for the initial venture into orthotics. The Assistant Executive Director maintains close contact both with clinics in the program and those which may participate in the future.

The Assistant Executive Director continued to serve as editor of the publication *Inter-Clinic Information Bulletin,* which is published in cooperation with New York University. Approximately 3000 copies are distributed monthly to physicians, prosthetists, therapists, and others interested in the care of the child amputee.

Clinic chiefs participating in the cooperative research program met at

Newington Children's Hospital, Newington, Conn., and Shriners Hospital, Springfield, Mass., March 23–24, 1972, at which time a symposium on Special Considerations Relating to the Child with a Limb Deficiency was conducted. An executive meeting of the subcommittee was held on March 25, 1972.

On June 14, 1972, staff members met with a group of selected orthopedic surgeons to plan a Conference on The Child With an Orthopedic Disability—His Needs and How to Meet Them. This conference will be held in Annapolis, Md., on November 19–21, 1972, and will be jointly sponsored by Howard University and CPRD.

Subcommittee on Sensory Aids

The Subcommittee on Sensory Aids held its seventh meeting, January 15, 1972, the primary purpose of the meeting being to develop guidelines for an evaluation program on sensory aids for the visually handicapped.

A Conference on the Long Cane was held in Washington, D.C., September 10–11, 1971, to standardize the design of and training with these devices.

A Conference on Evaluation of Sensory Aids for the Visually Handicapped was held in Washington, D.C., November 11–12, 1971. The conference sought to develop standard protocols to be applied in the appraisal of various devices for the blind now emerging from the research and development program.

A Conference on Standards for Low-Vision Aids was held in Washington, D.C., on May 9, 1972.

SPECIAL MEETINGS AND ACTIVITIES

Rehabilitation Engineering Centers

Members of CPRD and the Executive Director participated in meetings of the Rehabilitation Engineering Advisory Committee of the Social and Rehabilitation Service, September 13, 1971, and June 8–9, 1972. The Chairman and Executive Director of CPRD also met with personnel at the Rehabilitation Engineering Center at Temple University, August 1, 1971, to discuss the program at that center.

Conference on Nomenclature for Prosthetics and Orthotics

The CPRD Vice-Chairman and staff participated in a conference on nomenclature for prosthetics and orthotics sponsored by the Committee on Prosthetic-Orthotic Education in Washington, D.C., September 9–11, 1971. Staff members were also involved in a subsequent meeting in Washington, D.C., March 1–2, 1972.

Veterans Administration Seminars

The Executive Director and Staff Engineer served as members of the faculty of the VA-sponsored seminar in prosthetics and orthotics held in Houston, Texas, September 21–23, 1971. The Staff Engineer was also a faculty member at the VA-sponsored training program in prosthetics, orthotics, and sensory aids, held in San Juan, Puerto Rico, November 1–5, 1971, and Boston, Mass., April 19–21, 1972.

Prosthetics Course

The Assistant Executive Director was a member of the faculty for a course on *New Concepts in Upper-Extremity Orthotics* held at the Institute of Rehabilitation Medicine, New York University Medical Center, Jan. 24–25, 1972.

The Executive Director presented a paper at the *Symposium on Amputee Management* held at Rancho Los Amigos Hospital, March 20–22, 1972.

Artificial Limbs

The Autumn 1971 issue of *Artificial Limbs* was published during the reporting period. Material for another issue is in hand and in a well-advanced state of preparation.

On January 30, 1972, an *ad hoc* committee met in Washington, D.C., to consider the future of *Artificial Limbs*. The committee recommended that, since numerous other publications were now fulfilling the role once occupied solely by *Artificial Limbs*, the CPRD/CPOE publication should be discontinued.

International Society for Prosthetics and Orthotics (ISPO)

The Executive Director was appointed Chairman of ISPO's Publications Committee and will serve as editor of the ISPO *Bulletin*.

American Academy of Orthopaedic Surgeons (AAOS)

The staff continued to maintain strong relationships with AAOS through its Committee on Prosthetics and Orthotics, Committee on Biomechanics, and Committee on Rehabilitation. Staff members participated in the meetings of these committees during the AAOS Annual Assembly at the Shoreham Hotel, Washington, D.C., January 27–29, 1972.

Assistance is being provided the Academy in the preparation of a new textbook on orthotics and in the development of a means for the graphical representation of neuromuscular deficiencies.

American Orthotic and Prosthetic Association (AOPA)

Close liaison was maintained with AOPA, the American Board for Certification (ABC), and the newly formed American Academy of Orthotists and Prosthetists (AAOP) by personal contact and by staff participation in various Association activities. Both the Executive Director and the Assistant Executive Director presented papers at the Annual Assembly of the Association, October 31–November 4, 1971, in Las Vegas, Nevada.

Conference on Orthotics-Prosthetics Education (COPE)
University Council on Orthotics-Prosthetics Education (UCOPE)

The Assistant Executive Director continued to act as Secretary for both COPE and UCOPE. Combined meetings of the two groups were held in Washington, D.C., November 18, 1971, and April 12, 1972. These meetings provided a channel for the transmission of recommendations by CPRD for inclusion of significant new items in the educational programs.

Postgraduate Course in Lower-Extremity Prosthetics and Orthotics

A postgraduate seminar on Recent Developments in Prosthetics-Orthotics and Fracture-Bracing was held December 10–12, 1971, at the Americana Hotel in Miami Beach, Florida. The School of Medicine of the University of Miami conducted the seminar with co-sponsorship by the Committee on Prosthetics Research and Development and the Veterans Administration. Papers were presented by the Executive Director and Staff Surgeon.

President's Committee on Employment of the Handicapped

The Assistant Executive Director arranged a demonstration program on prosthetics, orthotics, and sensory aids, which was presented at the 25th Annual Meeting of The President's Committee on Employment of the Handicapped, held in Washington, D.C., May 3–5, 1972.

Workshop on Functional Neuromuscular Stimulation

In collaboration with the Social and Rehabilitation Service (SRS), National Institute of Neurological Diseases and Stroke (NINDS), and United Cerebral Palsy Research Foundation (UCPRF), a Workshop on Functional Neuromuscular Stimulation was held in Bethesda, Md., April 27–28, 1972.

International Activities

The Staff Engineer attended the Fourth International Seminar of the British Council for Rehabilitation of the Disabled, held in Edinburgh, Scotland, June 27–July 3, 1971.

On September 13–14, 1971, the Chairman, the Executive Director, and the Assistant Executive Director participated in a Conference on International Activities called by the Social and Rehabilitation Service. Plans for a Conference on Research, Evaluation, and Education, to be held in either Central Europe or North Africa early in 1972, were discussed. This Conference was subsequently held in Cairo, Egypt, May 1–11, 1972. The operation of the prosthetics and orthotics research program supported by PL 480 funds was also considered.

At the invitation of the Social Security Administration, the Committee members and staff met with members of a USSR delegation with special interests in prosthetics and orthotics on March 28, 1972.

On June 5–9, 1972, the Executive Director and selected Committee members participated in a study group on Prosthetics/Orthotics for Disabilities of the Locomotor System, conducted by the Pan American Health Organization in Washington, D.C.

Other international activities which involved staff and/or Committee member participation were: 5th International Congress of Orthopaedic Technicians in Paris, France, April 26–28, 1972; and a Meeting on Lower-Extremity Prosthetics, Bled, Yugoslavia, May 17–19, 1972.

FUTURE PLANS

The Committee on Prosthetics Research and Development proposes to continue its activities in the coordination and correlation of governmentally and privately sponsored research projects in the fields of prosthetics, orthotics, and sensory aids. In general, these activities fall into three broad categories: continuation of ongoing programs and relationships; furtherance of programs initiated or given new emphasis during the current fiscal year; and the initiation of new endeavors.

Continuation of Ongoing Programs

The well-established and highly productive system of workshop panels conducted under the aegis of the Subcommittee on Design and Development will be continued. New areas of activity initiated during the current year, particularly in the area of spinal and upper-limb orthotics, will be given increased emphasis.

Annual Summary Report

Ongoing projects under the auspices of the Subcommittee on Evaluation will be continued and completed. New projects will be activated as potentially significant devices and techniques emerge from the development program.

COMMITTEE ON PROSTHETICS RESEARCH AND DEVELOPMENT PUBLICATIONS

Annual Summary Report of Activities for Year Ended June 30, 1971. (Report to the Veterans Administration, the Social and Rehabilitation Service, and the Maternal and Child Health Service, from the Committee on Prosthetics Research and Development covering the Fiscal Year 1970–1971.)

The Child with an Acquired Amputation, National Academy of Sciences. Proceedings of a symposium held June 9, 1970, under the sponsorship of the Subcommittee on Child Prosthetics Problems. (In press.)

Report of Conference on Cast-Bracing of Fractures, January 27–28, 1971.

Report of Sixth Meeting of Subcommittee on Sensory Aids, February 26–27, 1971.

Report of Conference on Cosmesis and Modular Limb Prostheses, March 3–8, 1971.

Report of Twenty-Second Meeting of the Committee on Prosthetics Research and Development, May 17, 1971.

Report of Thirteenth Meeting of Subcommittee on Evaluation, August 5–6, 1971.

Report of Conference on the Long Cane, September 10–11, 1971. (In press.)

Report of Workshop on the Effect of Pressure on Soft Tissues, September 21–22, 1971.

Report of Second Workshop Panel on Upper-Limb Orthotics, October 3–5, 1971.

Report of Ninth Workshop Panel on Upper-Limb Prosthetics, October 25–27, 1971.

Report of Conference on Evaluation of Sensory Aids for the Visually Handicapped, November 11–12, 1971.

Report of Twenty-Third Meeting of the Committee on Prosthetics Research and Development, November 15–16, 1971.

A Clinical Evaluation of Four Lower-Limb Orthoses, Report E-5, 1971.

Report of Seventh Meeting of Subcommittee on Sensory Aids, January 15, 1972.

Workshop on Prosthetic-Orthotic Terminology—Interim Progress Report, March 1972.

Special Considerations Relating to the Child with a Limb Deficiency, National Academy of Sciences. Proceedings of a symposium held March 23–24, 1972, under the sponsorship of the Subcommittee on Child Prosthetics Problems. (In preparation.)

Report of Meeting of the Subcommittee on Child Prosthetics Problems, March 25, 1972.

Report of Workshop on Fundamental Studies for Internal Structural Prostheses, April 13–15, 1972. (In preparation.)

Report of Workshop on Functional Neuromuscular Stimulation, April 27–28, 1972. (In press.)

Report of Conference on Standards for Low-Vision Aids, May 9, 1972. (In preparation.)

Artificial Limbs, Vol. 15, No. 2, Autumn 1971.

Artificial Limbs, Vol. 16, No. 1, Spring 1972. (In preparation.)

Inter-Clinic Information Bulletin. (Published monthly under the sponsorship of the Subcommittee on Child Prosthetics Problems—12 issues.)

APPENDIX A

MAJOR PROJECTS IN THE UNITED STATES COORDINATED BY THE COMMITTEE ON PROSTHETICS RESEARCH AND DEVELOPMENT

PROSTHETICS AND ORTHOTICS

Organization and Responsible Investigator	Major Area(s) of Investigation	Sponsoring Agency [a]
Army Medical Biomechanical Research Laboratory Fort Detrick, Md. Orlyn C. Oestereich	Development of Prosthetic and Orthotic Materials and Devices	U. S. Army
California, University of Berkeley and San Francisco, Calif. Charles W. Radcliffe, Howard Eberhart, and James M. Morris	Design of Prosthetic and Orthotic Devices and Biomechanical Studies of Locomotion	VA
California, University of San Francisco, Calif. Verne T. Inman	Summation of Human Locomotion	SRS
R. F. Steidel	An Engineering Analysis of the Human Spinal Column	SRS
California, University of Los Angeles, Calif. Harlan C. Amstutz	Prosthetic and Orthotic Evaluation Procedures	SRS
John Lyman	Fundamental and Applied Research Related to the Design and Development of Upper-Extremity Externally Powered Prostheses	VA
Yoshio Setoguchi	Child Amputee Prosthetics Project	MCHS
Case Western Reserve University, Cleveland, O. Victor Frankel	Pathomechanics of Disorders of the Locomotor System	SRS

[a] Abbreviations:
MCHS — Maternal and Child Health Services
NEI — National Eye Institute
NIE — National Institute of Education
NINDS — National Institute of Neurological Diseases and Stroke
OE — Office of Education
SRS — Social and Rehabilitation Service
All of the above are within the Department of Health, Education, and Welfare
VA — Veterans Administration, Prosthetic and Sensory Aids Service

Organization and Responsible Investigator	Major Area(s) of Investigation	Sponsoring Agency [a]
Thomas Mortimer	Cybernetic Orthotic/Prosthetic Systems Development	SRS
Colorado State University Fort Collins, Col. Daniel Graupe	Control Logic for Upper-Limb Prostheses	VA
Emory University Atlanta, Ga. John V. Basmajian	Muscular Factors in Hip Dysplasia	MCHS
Georgetown University Washington, D.C. George W. Hyatt	Biophysical Evaluation of Healing Bone	SRS
George Washington University, Washington, D.C. William Fortune	Clinical Evaluation in Orthotics and Prosthetics	SRS
Harvard Medical School Boston, Mass. Richard Warren	Survey of Lower-Extremity Amputations	VA
Illinois, University of Chicago, Ill. Jorge Galante	A Study of Spinal Orthotics in Idiopathic Scoliosis	SRS
Iowa State University Ames, Iowa Allan Potter	Myoelectric Brace Development	SRS
Johns Hopkins University Baltimore, Md. Gerhard Schmeisser, Jr. Woodrow Seamone	Development and Evaluation of Externally Powered Upper-Limb Prostheses	VA
Massachusetts Institute of Technology Cambridge, Mass. Robert W. Mann	Rehabilitation Engineering Center	SRS
Igor Paul	Performance Testing of Artificial Joints	SRS
Mauch Laboratories, Inc. Dayton, Ohio Hans A. Mauch	Research and Development in the Field of Artificial Limbs	VA
Miami, University of Coral Gables, Fla. Augusto Sarmiento	The Development of Functional Methods of Treatment of Tibial, Femoral and Forearm Fractures	SRS
	Evaluation of Prosthetic-Orthotic Devices	SRS
	Study of the Development of Refined Fitting Procedures for Lower-Extremity Prosthetics	VA

Organization and Responsible Investigator	Major Area(s) of Investigation	Sponsoring Agency [a]
Michigan, University of Ann Arbor, Mich. G. E. Sharples	Child Amputees: Disability outcomes and Antecedents	MCHS
Moss Rehabilitation Hospital, Philadelphia, Pa. Richard Herman	Rehabilitation Biomedical Engineering: Orthotics Design	SRS
	Upper-Extremity Prosthetics	SRS
	Rehabilitation Engineering Center	SRS
	Neuromotor Control Systems: A Study of Physiological and Theoretical Concepts Leading to Therapeutic Application	SRS
Navy Prosthetics Research Laboratory, Oakland, Calif. W. R. Applegate and Charles Asbelle	Lower-Extremity Prosthetic and Orthotic Development	U. S. Navy
New York University New York, N.Y. Sidney Fishman	Child Prosthetic and Orthotic Studies	MCHS
Leon Bennett	Stump Stress Analysis (Mathematical Model)	VA
Sidney Fishman	Clinical Evaluation of Prosthetic and Orthotic Appliances	SRS
Richard Lehneis	Bioengineering Design and Development of Lower-Extremity Orthotic Devices	SRS
Northwestern University Chicago, Ill. Charles Fryer	Demonstration of Prosthetic and Orthotic Devices and/or Techniques	SRS
Clinton L. Compere	Rehabilitation Engineering Center	SRS
Robert G. Thompson	Prosthetic-Orthotic Research	VA
Rancho Los Amigos Hospital, Downey, Calif. Vert Mooney	Orthotic and Prosthetic Evaluation Center	SRS
James B. Reswick and Vernon L. Nickel	Rehabilitation Engineering Center	SRS
Roy Snelson	Feasibility Study of the Use of Transparent Sockets and Modular Prostheses in Clinical Practice	SRS

Organization and Responsible Investigator	Major Area(s) of Investigation	Sponsoring Agency a
Texas A & M Research Foundation College Station, Tex. Paul H. Newell, Jr.	Rehabilitation Engineering Center	SRS
	The Improvement of Prosthetic and Orthotic Devices through Materials Research, Analysis, Design, Clinical Testing, and Team Evaluation	VA
Texas Institute for Research and Rehabilitation Houston, Tex. Thorkild J. Engen	Clinical Evaluation in Orthotics and Prosthetics	SRS
	Research Developments of Lower-Extremity Orthotic Systems as they Relate to Patients with Various Functional Deficits	SRS
U.S. Public Health Service Hospital Carville, La. Paul W. Brand	Study of the Prevention of Deformity in Insensitive Limbs	SRS
VA Hospital Richmond, Va. Charles L. McDowell	Immediate Post-Operative Application of Upper-Extremity Orthoses	VA
VA Hospital San Francisco, Calif. Wesley Moore and Albert Hall	Study of Below-Knee Amputation for Vascular Insufficiency	VA
VA Hospital Seattle, Wash. Ernest Burgess	Immediate Postoperative Prostheses Fitting and Ambulation	VA
VA Prosthetics Center New York, N.Y. Anthony Staros	Research, Development and Testing of Prosthetic and Orthotic Devices and Techniques	VA
Virginia, University of Charlottesville, Va. Warren Stamp and David Lewis	Fitting of Lower-Extremity Prosthetics	SRS

PROJECTS IN THE DOMINION OF CANADA WHICH COOPERATE CLOSELY WITH THE OVERALL PROGRAM

Prosthetic/Orthotic Research Unit Ontario Crippled Children's Centre Toronto, Ont. Colin A. McLaurin	Development of a Wide Variety of Upper-Extremity and Lower-Extremity Body-Powered and Externally Powered Prosthetic and Orthotic Devices for Children

Organization and Responsible Investigator	Major Area(s) of Investigation	Sponsoring Agency [a]
Rehabilitation Institute of Montreal Montreal, Que. Maurice Mongeau	Development of Externally Powered Upper-Extremity Prosthetic Devices, With Special Reference to Children	
Prosthetics/Orthotics Research and Development Unit Manitoba Rehabilitation Hospital Winnipeg, Man. F. R. Tucker	Development of a Variety of Prosthetic Devices with Special Reference to Lower-Extremity Requirements	
The University of New Brunswick Bio-Engineering Institute Fredericton, N. B. R. N. Scott	Orthotics and Prosthetics Systems Research with Special Emphasis on the Employment of Electromyographic Signals as Controls	
	SENSORY AIDS [b]	
Albert Einstein College of Medicine Bronx, N.Y. Isabelle Rapin	Early Diagnosis of Hearing Loss with Evoked Responses	MCHS
American Institutes for Research Palo Alto, Calif. Robert Weisgerber	Educational Evaluation of the Optacon	OE
American Speech and Hearing Association Washington, D.C. William E. Castle	A Study of Hearing Aid Evaluation Procedures	MCHS
Argonne National Laboratory, U. of Chicago Argonne, Ill. Arnold P. Grunwald	A System for Compact Storage of Information on Magnetic Tape Readable by Touch as Braille Characters by Means of a Portable Reading Machine	OE
Arkansas Enterprises for the Blind Little Rock, Ark. Allan Ward	Evaluation of Ultrasonic Binaural Sensor (Kay Device)	SRS
Atlanta Public Schools Atlanta, Ga. Ernest L. Bentley	A Demonstration of Reader Services for the Visually Impaired Utilizing the Telephone as the Medium	OE
Bionic Instruments Bala Cynwyd, Pa. Thomas A. Benham J. Malvern Benjamin, Jr.	Development of Obstacle Detectors for the Blind	VA

[b] This is an expanded listing and includes some projects not presently coordinated by CPRD.

Organization and Responsible Investigator	Major Area(s) of Investigation	Sponsoring Agency [a]
California, University of Los Angeles, Calif. Victor Goodhill	Computerized Objective Auditory Testing in Infancy	MCHS
Franklin Institute, The Philadelphia, Pa. James Gumnick	Engineering Evaluation of the Optacon	OE
Gallaudet College Washington, D.C. J. M. Pickett	Wearable Visual Aid for Speech Communication in the Hearing Impaired	SRS
	Research on Frequency Transposition for Hearing Aids	NIE
Hadley School for the Blind Winnetka, Ill. Donald W. Hathaway	Development of Correspondence Courses for Personal Reading Aids for the Blind	VA
Hartford, University of West Hartford, Conn. Bernard Z. Friedlander	Automated Language Tests and Enrichment for Deaf Infants	MCHS
Haskins Laboratory New Haven, Conn. Franklin S. Cooper Jane Gaitenby	Research on Audible Outputs of Reading Machines for the Blind	VA
Illinois Visual Handicapped Institute Chicago, Ill. Thomas J. Murphy	Evaluation of Ultrasonic Binaural Sensor (Kay Device)	SRS
Institute of Medical Sciences San Francisco, Calif. Paul Bach-Y-Rita	Tactile Television System for the Blind	SRS
Frank A. Saunders	An Electrotactile Sound Detector for the Deaf	NINDS
The Johns Hopkins University Baltimore, Md. Louise Sloan	Analysis of Color and Form Vision in Ophthalmological Abnormalities and Their Treatment with Visual Aids	NEI, NIH
Maryland, University of College Park, Md. G. Donald Causey Earleen Elkins	Development of Improved Techniques for the Analysis of Hearing Aid Performance	VA
Massachusetts, Univer. of Amherst, Mass. I. B. Thomas	Speech-Analyzing Aids for the Deaf	NINDS
Massachusetts Institute of Technology Boston, Mass. George F. Dalrymple	Sensory Aids Development and Evaluation	SRS

Organization and Responsible Investigator	Major Area(s) of Investigation	Sponsoring Agency [a]
Mauch Laboratories, Inc. Dayton, Ohio Hans A. Mauch Glendon C. Smith	Development of Personal Reading Machines for the Blind	VA
National Accreditation Council for Agencies Serving the Blind and Visually Handicapped New York, N.Y. Alexander F. Handel	Strengthening Services for the Visually Handicapped through the Application of Standards	SRS
New Mexico State University Los Cruces, N.M. Edgar Garrett	A Systems Approach to the Optimization of Speech Therapy Services in the Schools	OE
Northwestern University Evanston, Ill. Raymond Carhart Wayne O. Olsen	Development of Test Procedures for Evaluation of Binaural Hearing Aids	VA
Queens College Flushing, N. Y. J. H. Kirman	Tactile Communication of Speech to the Deaf	NIMDS
Rand Corporation Santa Monica, Calif. S. M. Genensky	Information Transfer Problems of the Partially Sighted	SRS
Smith Kettlewell Institute of Visual Sciences U. of Pacific Med. Sch. San Francisco, Calif. Carter C. Collins	Develop Portable Seeing Aid Using Tactile Television System	NEI, NIH
Paul Bach-Y-Rita	Develop Neurophysiological Basis for Design of Portable Seeing Aid	NEI-NIH
Stanford University Stanford, Calif. James C. Bliss John G. Linvill	Research and Development of Tactile Facsimile Reading Aid for the Blind	OE
Telesensory Systems Inc. Los Altos, Calif. James C. Bliss	Manufacture of Optacons for a Field Trial Within Elementary and Secondary Schools	OE
Tennessee, University of Knoxville, Tenn. Carl W. Asp	Effectiveness of Low-Frequency Amplification and Filtered-Speech Testing for Pre-School Deaf Children	OE
Texas, University of Medical Branch Galveston, Tex. Byron J. Bailey	Development of Laryngeal and Tracheal Prostheses	NINDS

Organization and Responsible Investigator	Major Area(s) of Investigation	Sponsoring Agency [a]
VA Hospital Hines, Ill. John D. Malamazian Harvey L. Lauer	Clinical Application of Reading and Mobility Aids for the Blind	VA
Western Blind Rehabilitation Center VA Hospital Palo Alto, Calif. Loyal E. Apple	Clinical Application Program in Reading and Mobility Aids for the Blind	VA
Western Michigan University Kalamazoo, Mich. Donald Blasch	Evaluation of Ultrasonic Binaural Sensor (Kay Device)	SRS

APPENDIX B

SUBCOMMITTEE ON CHILD PROSTHETICS PROBLEMS

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